

# Use of a mixture of powdered Montmorency tart cherry skin, highly standardized *Tanacetum parthenium* extract and bromelain in powerlifting athletes: a preliminary study

## Abstract

Exercise-induced muscle damage (EIMD) is a transient phenomenon following intense exercise. EIMD is caused by structural damage to myofibers and secondary inflammation resulting from leukocyte infiltration into the damaged tissues. It is associated with temporary decrements in maximal force-generating capacity, acute and delayed onset muscle soreness (DOMS), localized swelling, decreased pressure pain threshold, elevated levels of intramuscular enzymes (creatine kinase, lactate dehydrogenase and myoglobin) and elevations in markers of inflammation such as C-reactive protein and interleukins.

Several nutraceutical principles have documented anti-inflammatory and antinociceptive effects that may be useful in managing EIMD, including tart cherry (*Prunus cerasus* L.), which has already been evaluated in different forms in the sports field, feverfew (*Tanacetum parthenium* L.) and bromelain, which with different mechanisms of action, can intervene in the modulation of inflammatory responses and nociception.

In this preliminary study, 15 subjects took one sachet per day of a mixture of dried Montmorency tart cherry skin powder (CherryPURE™), feverfew dry extract and bromelain (marketed under the name 'Freedoms') for seven days. This was followed by an equivalent seven-day control period in which they took a powdered blend of electrolytes and vitamins (containing potassium citrate 20% NRV, magnesium citrate 50% NRV, zinc citrate 75% NRV and vitamin C 150% NRV and vitamin E 100% NRV) reconstituted in water, making a drink indistinguishable from that relating to the nutraceutical product. The Freedoms–control cycle was repeated twice, separated with a seven-day washout, for a total of 28 treatment days and seven washout days.

Alexander Bertuccioli<sup>1\*</sup>,

Giordano Zonzini<sup>2</sup>,

Andrea Bernabucci<sup>2</sup>

<sup>1</sup> Department of Biomolecular Sciences, University of Urbino Carlo Bo, 61029 Urbino, Italy

<sup>2</sup> AIFeM Ravenna, Italy

\*Corresponding author:  
Alexander Bertuccioli

alexander.bertuccioli@uniurb.it

The scores, relating to the scales used on the Borg CR-10 ratings of perceived exertion (RPE) were independently collected by the evaluated subjects both in the weeks of taking the nutraceutical product and in the weeks of taking the control product. The intake of Freedoms, when compared to the intake of a mixture of electrolytes and vitamins, over seven days, correlates with a 7.1% reduction in Borg CR-10 rated RPE, potentially contributing to the use of higher loads and the overall realization of higher training volumes. Further evaluations in the future, using a larger sample, more circumscribed with more uniform criteria, over a longer timeframe, are necessary to further clarify the application potential of this nutraceutical blend.

**Keywords:** Powerlifting, EIMD, DOMS, CherryPURE™, Montmorency tart cherry, *Tanacetum parthenium*, training volume, RPE, CR-10

## Introduction

The days following high-intensity exercise can be associated with several side effects, which may include temporary decrements in maximal force-generating capacity, muscle soreness, localized swelling, decreased pressure pain threshold (PPT), elevated levels of intramuscular enzymes (creatinase kinase or CK, lactate dehydrogenase or LDH and myoglobin or MYO) and elevations in markers of inflammation such as C-reactive protein (CRP) and interleukins<sup>[1-3]</sup>.

This transient phenomenon following intense exercise, known as exercise-induced muscle damage (EIMD), is due to structural damage to myofibers and secondary inflammation resulting from leukocyte infiltration into the damaged tissues, and it is particularly evident following unaccustomed activities<sup>[4-6]</sup>.

These phenomena constitute a key component in the adaptive remodeling processes underlying recovery and supercompensation<sup>[7]</sup>. Their modulation must be managed to avoid compromising the benefits derived from training but may offer an advantage to athletes who require a quick return to a basic performance capacity, at least, such as when competing in tournaments or close competition etc.<sup>[4, 8]</sup>. The most employed approaches for this purpose include stretching, massage, electrotherapy, cryotherapy, nutritional and nutraceutical strategies and non-steroidal anti-inflammatory drugs (NSAIDs)<sup>[4, 9]</sup>.

Numerous nutraceuticals can exert potentially useful effects in countering EIMD<sup>[10]</sup>, including, when consumed in sufficient quantities, the tart cherry (*Prunus cerasus* L.), generally consumed in juice form or dried and powdered tart cherry skin.

The anti-inflammatory and antioxidant effects of tart cherries are generally attributed to their high content of anthocyanins. Several studies report that the consumption of tart cherry juice for seven to eight days before evaluation is associated with less perceived pain, better recovery, ameliorate decrements in muscle function and reduction of EIMD markers related to the practice of high-intensity exercise<sup>[10–16]</sup>.

Similar results are reported even with the consumption of powdered tart cherry skin<sup>[17]</sup>.

Similar results were also obtained by evaluating the use of juice or dried and powdered tart cherry skin in intermittent or extended endurance activities<sup>[18–21]</sup>.

With the same purpose of intervening on EIMD, it is also possible to consider the use of feverfew (*Tanacetum parthenium* L.) for its documented anti-inflammatory and antinociceptive activity, which is generally attributed to the presence of parthenolide<sup>[22–23]</sup>. Furthermore, parthenolide shows the ability to inhibit the contraction of smooth muscle, with documented effects at the digestive and vascular level.

The effects at the vascular level could be of particular interest in the synergistic recovery processes with the anti-inflammatory, antinociceptive and antioxidant effects already described<sup>[22–27]</sup>.

Bromelain is a proteolytic enzyme derived from pineapple that elicits an anti-inflammatory response by reducing prostaglandin E2 (PGE-2) and cyclooxygenase-2 (COX-2) synthesis<sup>[28]</sup>.

Miller *et al.* report that the anti-inflammatory action of bromelain is associated with increased tissue permeability, facilitating resorption of oedema and accelerated restructuring of the damaged tissue, may reduce delayed onset muscle soreness (DOMS), facilitate muscle healing, and allow for faster restoration of contractile function after intense exercise in downhill running athletes<sup>[29]</sup>. The purpose of this study is to evaluate whether the combination of dried and powdered tart cherry skin, feverfew dry extract and bromelain can have a

positive effect on maximal resistance activity such as powerlifting.

## Methods

### Study overview

This was a clinical trial that analyzed the results of 28 days of treatment during which 15 amateur powerlifting athletes alternated seven-day microcycles in which, in addition to their normal diet and supplementation programme, they took a nutraceutical product for seven days, followed by seven days during which they took a blend of electrolytes and vitamins containing potassium citrate (20% NRV), magnesium citrate (50% NRV), zinc citrate (75% NRV), vitamin C (150% NRV) and vitamin E (100% NRV). The electrolyte and vitamin blend was consumed in powder form reconstituted in water, making a drink indistinguishable in texture and flavour from the nutraceutical product.

The nutraceutical supplementation was taken for a total of 28 days, repeating the nutraceutical-control cycle twice, with a washout week between the two cycles. The nutraceutical supplement comprised a mixture of 480 mg of freeze-dried Montmorency tart cherry skin powder derived from tart cherry skins obtained after juicing (CherryPURE™ Freeze-Dried Tart Cherry Powder, Shoreline Fruit, LLC, Transverse City, MI, USA), 250 mg of feverfew dry extract titrated at 0.5% in parthenolide and 250 mg of bromelain 2500 GDU/g. For each training session, Ratings of Perceived Exertion (RPE) was determined with the Borg CR-10 scale<sup>[30]</sup>, with a numerical rating format, using a procedure described in the literature. Data studies and analysis were conducted in accordance with good clinical practice rules fixed by the Declaration of Helsinki and in accordance with the European Union Directive 2001/20/EC<sup>[31]</sup>. Each patient signed a consent form and privacy policy documents and approved data analysis and publication.

## Participants

Data from 15 adult men aged between 21 and 34, with a BMI between 22 and 30, who had been practising powerlifting regularly for at least three years continuously was examined. Each athlete was required to train for a minimum of three to a maximum of five times per week, and followed a programme that included squats, bench press and deadlifts as a base and to which, depending on the case, specific complementary exercises were added. Participant characteristics are reported in **Table 1**.

## Inclusion and exclusion criteria

Ongoing pathologies; treatment with anticoagulants, anti-inflammatories, analgesic; the execution of specific physiotherapy treatments; recent injuries; changes to usual food consumption; behaviour and drug use (smoking, alcohol consumption) and extra physical activity in addition to that usually scheduled constituted the exclusion criteria.

## Evaluated products and evaluation scheme

For seven days, the 15 subjects whose data was examined, took one sachet per day of a mixture of dried Montmorency tart cherry skin powder, feverfew dry extract and bromelain, produced by Aquaviva s.r.l. (Aquaviva, San Marino Republic), and notified to the Italian Ministry of Health as a food supplement by complying with law no. 169-2004 (notification number: 100269), marketed under the name 'Freedoms'. Freedoms contains 480 mg of freeze-dried Montmorency tart cherry skin powder derived from tart cherry skins obtained after juicing (CherryPURE™ Freeze-Dried Tart Cherry Powder, Shoreline Fruit, LLC, Transverse City, MI, USA), 250 mg of feverfew dry extract titrated at 0.5% in parthenolide and 250 mg of bromelain 2500 GDU/g packaged as sachets of instantaneously soluble powder. Freedoms intake was followed by an equivalent seven-day control

period in which participants took a blend of electrolytes and vitamins containing potassium citrate (20% NRV), magnesium citrate (50% NRV), zinc citrate (75% NRV), vitamin C (150% NRV) and vitamin E (100% NRV) in powder form reconstituted in water, making a drink indistinguishable in texture and flavour to the nutraceutical product.

The Freedoms-control cycle was repeated twice for a total of 28 days, separated with a seven-day washout. The scores relating to the RPE scale for each training session were independently collected by the subjects and evaluated both in the weeks of taking the nutraceutical product and in the weeks of taking the control product. Anthropometric data such as height and weight were obtained according to the standard methods.

## Statistical analyses

Descriptive analyses were reported as mean and standard deviation. In a simple two-period, two-group crossover study, each mean effect can be reported as m.n, where m (1 or 2) was treatment (Freedoms or control) and n (1 or 2) was period (1 = first cycle 2 = second cycle). RPE was determined with the Borg CR-10 scale<sup>[30]</sup>, with a numerical rating format, using a procedure described in the literature.

A standard definition of perceived exertion and instructional sets for the Borg CR-10 scale were read to the subjects immediately before the exercise test. Treatment, time and carryover effect was assessed according to Grizzle<sup>[32]</sup>.

To test treatment effect, the sum of the results of treatment 1 was compared with the treatment 2 results (1.1 + 1.2 versus 2.1 + 2.2).

To trace time effect, the sum of the results in period 1 was compared with the period 2 results (1.1 + 2.1 versus 1.2 + 2.2).

Finally, to trace an eventual carryover effect, the sum of the results in obtained following treatment 1 were compared with the results obtained following treatment 2 (1.1 + 2.2 versus 1.2 + 2.1). These null hypotheses have been tested using paired t-tests.

All data were analyzed using Excel 365 or SPSS version 20.0 (SPSS Inc., Chicago, Illinois); the significance threshold was fixed at 0.05.

## Results

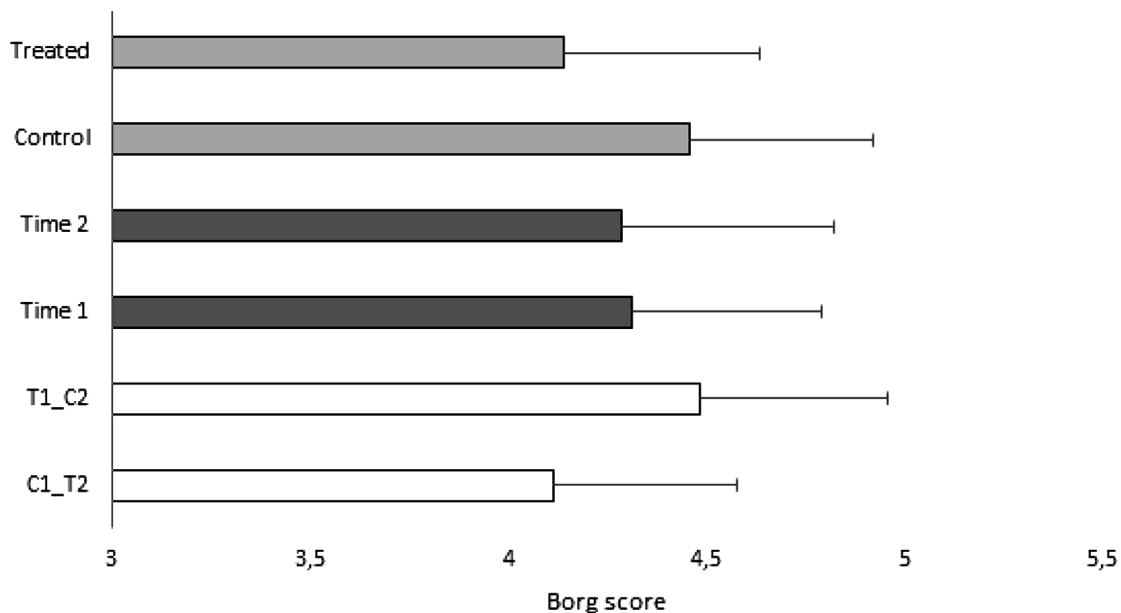
Fifteen subjects were included in the trial. No participant discontinued treatment (Freedom or control) during the trial period. The data presented in **Table 1** records the descriptive statistics of the participants, Borg scores of the effect of treatment (treated versus control), time effect (time 1: first cycle versus time 2: second cycle) and carryover effect. Borg score value in the treated group was  $4.14 \pm 0.49$ , while in the control group the value was  $4.46 \pm 0.46$ ; the effect of treatment was significant ( $t = 2.39$ ;  $p = 0.028$ ; % change = -7.1%).

There was a non-significant period effect from first to second cycle in Borg score ( $t = 0.123$ ;  $p = 0.900$ ; % change = -0.6%) and a non-significant carryover effect ( $t = 1.780$ ;  $p = 0.091$ ; % change = 9.0%).

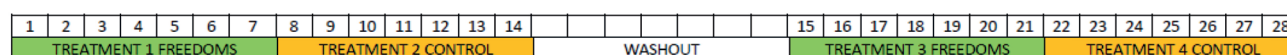
Carryover effect showed a difference close to significance levels; this could be because the treatments can leave a slight effect even in the following days.

Age (years)	$27 \pm 7$
Weight (kg)	$69.8 \pm 9.5$
Height (m)	$1.75 \pm 0.08$
BMI (kg/m <sup>2</sup> )	$22.7 \pm 2.4$

**Table 1:** Descriptive statistics of participants



**Figure 1:** Treatment (treated vs control); time (first cycle vs second cycle); carryover effect (treatment 1 and control 2 vs treatment 2 and control 1). Results were reported as mean and standard deviation.



**Figure 2:** Evaluation protocol

## Discussion

At the end of the entire evaluation period, it emerged that the intake of Freedoms is correlated to a reduction of the RPE evaluated with the Borg CR-10 scale of 7.1%.

This, in harmony with what has already been analyzed in the literature, could be related to the anti-inflammatory properties exerted by the anthocyanins of cherry tart and the parthenolide of feverfew and bromelain. The use of different mechanisms of action in the modulation of training-related inflammatory processes could be at the basis of the reduction in RPE, an effect that could last over time as suggested by the values related to the study of a possible carry over, consequently requiring the adoption of a more protracted washout period in a more exhaustive study. The variation in the RPE of 7.1%, even if apparently modest, can allow – especially if not considered from the perspective of a single training session but in a specific micro-cycle within a broader plan – both the use of higher workloads and the development of higher work volumes.

These factors are potentially at the basis of greater training effectiveness, as previously analyzed for other disciplines in relation to the study of the properties of tart cherry [11-21]. Particularly relevant is the fact that the use of Freedoms was not related to any type of adverse event and that none of the participants needed to stop taking it, with virtually complete overall tolerability. The reduced sample size, combined with the heterogeneity of the sample under consideration, constitute limitations of the work. Future studies on larger samples with more restricted recruitment dynamics will further clarify the real potential of this nutraceutical blend, even if it is likely that the result found on a sample with the described characteristics of heterogeneity could be even higher in a more uniform sample.

## Conclusions

The data obtained from this preliminary study demonstrates how the intake of Freedoms (480 mg of freeze-dried Montmorency tart cherry skin powder derived from tart cherry skins obtained after juicing CherryPURE™, 250 mg of feverfew dry extract titrated at 0.5% in parthenolide and 250 mg of bromelain 2500 GDU/g) for seven days compared to a mixture of electrolytes and vitamins (potassium citrate 20% NRV, magnesium citrate 50% NRV, zinc citrate 75% NRV, vitamin C 150% NRV and vitamin E 100% NRV) that is indistinguishable by texture and flavour to Freedoms correlates with a 7.1% reduction in Borg CR-10 rated RPE, potentially contributing to the use of higher loads and the overall realization of higher volumes of work. Further evaluations using a larger sample, more circumscribed with more uniform criteria, over a longer timeframe are necessary in the future to further clarify the application potential of this nutraceutical blend.

## Conflict of interest

Alexander Bertuccioli carries out consultancy in the sports field for the manufacturer of Freedoms.

Giordano Zonzini carries out consultancy in the health sector for the manufacturer of Freedoms.

Andrea Bernabucci has no conflicts of interest.

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